Smart Home IOT

P. Venkatesh, Rani Thottungal, J.Ramprabu

Abstract-This paper describes how IoT connects all the electrical appliances to the internet and feeds the data to the online dashboard with periodic interval. It provides two-way communication that helps to keep the status of all the devices in the Smart Home IoT and controlling them using smart-phone from any place of the world. By programming we can have the control of electrical equipment power consumption and reduce the electricity bill. The moment switching on the Air conditioner the Windows are automatically closed parallel fans in that room is switched off, thus avoids the excess energy consumption. Gas sensor alerts the gas leakage in kitchen to the owner of the house irrespective of availability in home. Flame sensor also detects and inform to the house owner if any flame occurs. The control and switching of devices can be achieved by either physical switch or smart-phone app. The monitoring may have designed as live dashboard, gauge, widget led in smartphone.

Keywords: Ethernet shield, Smart Home, Blynk app, sensors

I. INTRODUCTION

According to [4] half of the Americans citizens are interested and investing in smart home technology. Modern culture drives all persons into busy schedule so that they cannot remember all the state of electrical things and devices in all time. So the energy wastage will happen due to improper access and maintenance of electrical appliances. Sometimes may forget to switch off the lights, fans, water heater, air conditioner etc., and sometime they may run the AC while the windows kept open. These all are leads the electrical energy wastage and should be avoided. [5] discussed Energy limit control for residence. [1]gives the basic idea of IoT for wide area networkSmart home IoT [SHIoT] helps to avoid this problem and ensures the proper operation of all home appliances evaluated with proper necessity. It it is violated or reached the threshold, safeguard action is triggered and indication sent to smartphone of the user. Constrained application protocol used by[1]User can control the devices from anywhere of the world and read the state of all the things connected the SHIoT. This will provide reliable operation of the monitoring and controlling of the things connected to the SHIoT through internet connected smartphone.[4] uses web-based remote control for IoT applications. Flow problems are avoided in [2] by linear programming.

The SHIoT acts as the home based assistance and will respond all the aspects of the home based electrical equipment connected to the SHIoT. Smart management control system to efciently control the operating time of the electronic appliances [6]The smartphone application is developed by third party service provider and it ensures the reliable and user friendly user interface to improve the SHIoT. The controller used in SHIOT is belongs to AVR family. It is the core part of the Smart Home IoT. Here the version is ATMEGA328 which is 8-bit controller with inbuilt ADC of 6 channel 10-bit resolution. Six PWM output lines and seven Digital I/O lines are available. I2C, UART and SPI protocols are supported in this controller for Communication, programming and debug purposes. Switches and sensors are inputs and Relay driver circuit is the output. Sensors are defined very clear in [3] and their important characteristics

Internet connectivity is enabled by the means of W5100 based Ethernet shield. This can be interface and access with the controller by SPI protocol. The controller should be alive for all time so the battery power is recommended but here I am using AC/DC 12V adapter and regulated to 5V constant DC using L7805CV circuit.

The appliances and equipment are operated in AC supply but the controller output is DC only, so the relay driver circuit is used to connect electrical devices to the controller. [10]Cultivation field is automated with the help of microcontroller from remote area using mobile phones are discussed in [7]. The data privacy and piracy using FPGA are discussed in [8]

II. METHODOLOGY

The input and output devices such as switches, sensors and relay driver circuit are connected to the controller by through I/O ports. The controller is continuously connected to the internet through the Ethernet shieldWhenever we press any switch appropriate signal trigger signal is send to controller according to the program the signal is evaluated and the corresponding light, fan or any other equipment is switching to opposite state that means if it is in ON state then it will become off and if we want to turn it on we need to press the same button again. The same kind of operation can be performed by smartphone from anywhere of the world. When we press any physical button it will update to the online and we can see the state of swich by Smartphone and the state of corresponding device switching.

LM35 is used as temperature sensor which is manufactured by Texas Instrument. This directly converts the temperature in the ratio of Celsius this sensor has three pins as vcc, ground and output

The analogue output is given to the analog pin of the microcontroller and processed. The instant temperature value is uploaded to the smart phone continuously the value of temperature sensor also used for the air conditioner and

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Fan switching operations. While operation of AC the window state is evaluated if it is in open condition window on of motor driver is triggered and ensures the window keeps in close state. If user try to open the window, the controller givers alert signal.

Flame sensor is installed to get alert if there is any fire accident, if needed we can switch the water spraying pump to control the fire from smartphone or we can program to switch the spraying pump if the flame value is very high.

Gas sensor is installed in kitchen, if there is any gas leakage detected, alert is given to user through smartphone and suggest to open the windows, if we accept the alert, we can save the home by opening the windows.

III. FLOW CHART

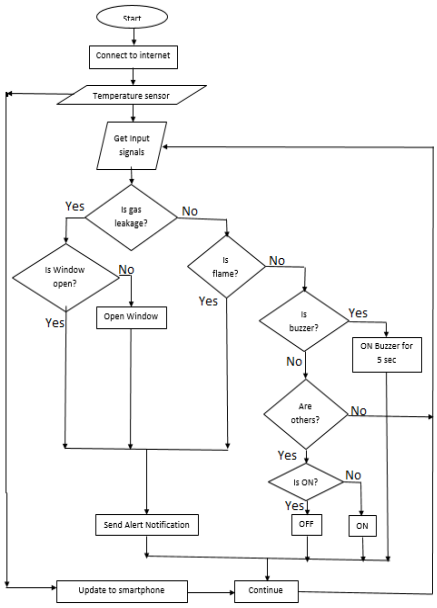

Fig 1: Flow Chart Of The Shiot

IV. BLOCK DIAGRAM

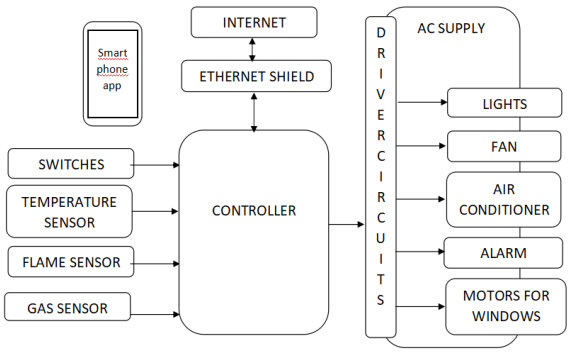

Fig 2: Main Block Diagram

A. Block Description

a. Controller

It is the core part of the project which is responsible to scan the input signal from switches and sensors and performing the processing to actuate the appropriate output devices. The microcontroller used here is atmega328. It is a bit controller operated in RISC instruction set and has 32 KB of in system flash memory, 1 kb of EEPROM, 1KB of SRAM and 29 GPIO pins. Since it has the inbuilt Six Channel 10-bit ADC we can interface the sensor signal to this controller directly. The IO ports has internal pull up resistors. I2C, SPI and UART protocols are supported by this controller. 6 pwm output channels also available in this controller

b. Input devices

Switches used here are general Electrical switches which are configured with potential divider principle and connected to the analog pin of microcontroller because more input lines will occupy more GPIO pins but the microcontroller has only 29 GPIO pins other input signals provided by the temperature sensor, flame sensor and gas sensor.

Temperature sensor provide the analog output proportional to the temperature in Ambience in the ratio related to Celsius. Flame sensor is based on the sense of heat radiation in the installed premise. If the heat radiation is related to the fire accident level it gives the analog signal proportional to the controller. Gas sensor keeps detecting the LPG gas spreading in the installed Ambience and sends the signal to the controller.

c. Ethernet shield

It provides the connection to internet for microcontroller and can be utilised by SPI protocol. It is based on W5100 controller and the connectivity is by Ethernet cable. This is widely used by all the students and mentors to perform the internet access for their circuit development. It needs 5-volt dc supply to operate and has header pins if this is stack on the development microcontroller boards. This is designed for general purpose but widely used with arduino boards

d. Driver circuits

There are two types of driver circuit used here they are relay driver circuit for AC applications and motor driver circuit for DC Motors. The Relay circuit is built by the components of 5-volt dc relay PNP transistor and diode. The transistor is used to bring alive the relay when base signal is brought from controller. The indicating led is provided to visual confirmation of the relay actuation.

e. Output devices

Lamps, DC fans and Motors are used as output devices. Here the smartphone also an output device as well as input device since it gets updates and provision to control the devices. Lamps are operated with 230 volt AC supply and the fan and motors are operated by the 12 volt dc supply.

f. Smartphone Application

The mobile application used for the project is Blynk application which is free application for the internet of things developers to kick start. This gives very good user interface gauge variety and ease of access. We can modify this application for our own design if we know the Android application development. The application generates unique

authentication token for every new project and sends to the mail which we gave while register. We should define that authentication token while dumping the code to the controller

V. CIRCUIT DIAGRAM

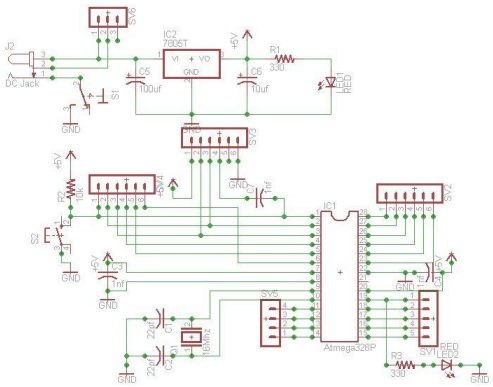

Fig 3: Circuit Diagram

VI. CIRCUIT DESCRIPTION

The controller works in 5 volt supply so that the AC supply is converted to 12 volt dc supply by means of AC to DC adaptor and in further step down and regulated into 5 volt constant DC using L7805CV IC. A capacitor used at input side of the regulator is to filter the ripples in the supply and the capacitor used in output side of the regulator is to give smooth DC supply even there is any noise or jitter in the circuit. One indication led is provided to ensure the circuit gets supply. First pin of the controller is reserved for reset operation, hear the reset is active low hence it should be connected to the vcc with pull up resistors to perform the normal operation. The power on reset is happened while switch on the controller with supply, if we want to hardware reset, a switch is provided to connect the reset pin to ground for a while because the reset pin is active low pin. So that it will reset the controller if low pulse is given to the pin. While reset operation is performing by the controller, the program counter is cleared and the controller will go to the starting of main function address location, the flag registers are reset to starting stage and the stack memory is cleared.

Firmware update is done by either UART or ISP because this controller supports both protocols. The Ethernet Shield connected to the controller by SPI pins as well as headers to make connectivity to the internet. The circuit also provided with 16 MHz crystal to provide clock pulse to the controller. 16 MHz is recommended by the microcontroller datasheet.The input and output devices also connected to the controller by means of headers with jumper wires since those are separate modules.

VII. RESULT

The outcome of the project is tested with prototype in various aspects of monitoring and control. The internet access is provided through Ethernet cable and shield, and the testing is carried out by both physical switches and virtual smartphone switches.The monitoring is performed from the gadgets in smartphone application and the controls also performed using smartphone. The alert messages are received to smartphone when the threshold level is reached by the caution sensors.

The state of every apparatus is updated at all instant to the internet which is verified using the mobile phone application. The physical switching also updated to the mobile application instantaneously.

Window open/close motor actuation is observed either by physical/gaged switch or while the warning condition such as AC switching or Gas leakage detection.

Switches [phy or soft]	Corresponding device	Sensors
1	Buzzer	Temperature sensor
2	Lamp1	Flame sensor
3	Lamp2	Gas sensor
4	Fan	
5	AC	
6	Window motor driver	

Table 1: Assignment Of Switches

Switching/sensing	Process 1	Process 2	Process 3
1[phy]	Buzzer ON	Update to server	
2[app]	Lamp 1 ON	Update to server	
3[phy]	Lamp 2 ON	Update to server	
5[Phy]	AC ON	Update to server	Window close
Flame detected	Alert to mobile	Update to server	Trigger buzzer
2[phy]	Lamp 1 OFF	Update to server	
Gas detected	Alert to mobile	Update to server	Window open
3[app]	Lamp 2 OFF	Update to server	

Table 2: Result For Various Input Cases

VIII. CONCLUSION

This project can be installed in real time for every home and can perform all the functionalities defined in this document without any error or malfunction. It is quite cheap, reliable, less requirements and easy to install in real time compared to other smart home research algorithms.

This project is for the beginning level smart home and it can be extended to get luxurious experience if the artificial intelligence, image and voice processing are included. The authentication and security encryption can be adopted when the use of higher end processors and protocols.

IX. PHOTOCOPY

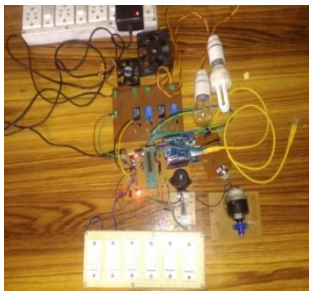

Fig 4: Project Prototype Photocopy

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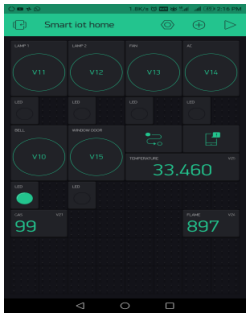
BLYNK MOBILE APPLICATION



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